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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/522,779	02/01/2005	Shinji Sakashita	265060US0PCT	1756

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OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER	
VELASQUEZ, VANESSA T	

ART UNIT	PAPER NUMBER
1793	

NOTIFICATION DATE	DELIVERY MODE
10/05/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@oblon.com
oblonpat@oblon.com
jgardner@oblon.com

Office Action Summary	Application No.	Applicant(s)	
	10/522,779	SAKASHITA ET AL.	
	Examiner	**Art Unit**	
	Vanessa Velasquez	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 July 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,7-9,11-13 and 15-18* is/are pending in the application.

4a) Of the above claim(s) *15* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,7-9,11-13 and 16-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on July 10, 2009 has been entered.

Status of Claims

Claims 3-6, 10, and 14 are canceled. Claim 15 is withdrawn from consideration. Currently, claims 1, 2, 7-9, 11-13, and 16-18 are presented for examination on the merits.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1, 2, 7, 9, 11-13, and 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miyamoto et al. (EP 1 126 139 A) in view of Grunke et al. (US 4,936,927), and further in view of Lütjering et al. (*Titanium*) and Yao et al. (US 6,066,359).

Regarding claims 1, 11, 16, and 17, Miyamoto et al. teach a titanium alloy comprising 0.5-2.3% by mass of aluminum and inevitable impurities with titanium

constituting the balance (para. [0009]). The alloy possesses, among other properties, enhanced resistance to heat and oxidation (abstract).

Miyamoto et al. do not teach an aluminum concentration layer as claimed. Grunke et al. teach a method of applying diffuse aluminum coatings on titanium or titanium alloy in order to protect the alloy from oxygen embrittlement (abstract; col. 3, lines 1-7). The method includes twice heat treating titanium or titanium base alloy such that the aluminum diffuses into the base alloy, thereby forming a coating comprising a titanium-aluminum intermetallic phase that is partially or fully dissolved (col. 3, lines 49-68 to col. 4, lines 1-15). Depending on the length of the heat treatment, the intermetallic phases formed are $TiAl_2$, TiAl, and Ti_3Al (Fig. 2a; col. 3, lines 49-61), which correspond to approximately 53.0%, 36.0%, and 15.8% by mass aluminum, respectively. (Refer to explanation of calculation below if needed.) It is noted that 15.8 mass % Al lies within the claimed range. It would have been obvious to one of ordinary skill in the art to have applied the aluminum coating of Grunke et al. on the titanium alloy of Miyamoto et al. for the purpose of further enhancing its resistance to oxygen embrittlement. It is further noted that the concentration of 15.8 mass% Al in Grunke et al. exceeds the concentration of the Al content in alloy of Miyamoto et al. (0.5-2.3%) by at least 13.5% (=15.8-2.3), which overlaps the claimed range.

Miyamoto et al. in view of Grunke et al. are silent as to the presence of an oxide later on top of the concentrated layer. However, the presence of oxide on titanium-aluminum compounds is inherent, as evidenced by Lütjering et al. Lütjering et al. teach that Al_2O_3 and crystalline TiO_2 naturally form on titanium aluminides that have been

exposed to air (page 48-49, para. 2.9.3; Fig. 2.32). It is the aforementioned oxides that are responsible for the oxygen resistant nature of titanium-aluminum alloys at select, but not all, temperatures.

Miyamoto et al., Grunke et al., and Lütjering et al. are silent as to the thickness and degree of crystallinity of the oxide phase. Yao et al., drawn to a method of producing titanium oxide thin film, teach a titanium oxide thin film that is 0.1 micron (100 nm) to 5.0 microns thick (col. 5, lines 50-52) and fully crystalline (col. 5, lines 44-47). The oxide can be formed on metal substrates (col. 5, lines 1-6) and is corrosion resistant (abstract). It would have been obvious to one of ordinary skill in the art to grow additional crystalline oxide, as disclosed by Yao et al., on the surface of the alloy of Miyamoto et al. in view of Grunke et al. because the thin crystalline film would enhance the corrosion resistance of the titanium.

Regarding claims 2 and 13, Miyamoto et al. further disclose that "any alloying element other than Al may be incorporated [in the titanium alloy] so far as the feature of the present invention is not lost"([0009]), meaning that additional elements are optional, i.e., they can be present or not present (zero percent), which overlaps the claimed range.

Further regarding claim 13, the claim recites the transitional phrase "consisting of[,]" signifying closed language per MPEP § 2111.03. The alloy of Miyamoto et al. meets the claim, as additional elements are optional, or in other words are not required to be present and may assume a value of zero percent.

Regarding claim 7, the thickness of the aluminum gradient layer is less than 35 microns (Grunke et al., col. 3, line 24), which encompasses the claimed range.

Regarding claims 9 and 12, the titanium oxide of Yao et al. may be in brookite form (col. 3, lines 23-26, 66-67).

Regarding claim 18, Grunke et al. teach that the content of aluminum continually decreases from the surface of the coating toward the titanium or titanium alloy base metal (col. 4, lines 1-15; Figs. 2b and 3b). Therefore, the aluminum content would decrease from 15.8% to that of the base (bulk) metal, thereby encompassing the claimed range.

6. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Miyamoto et al. (EP 1 126 139 A) in view of Grunke et al. (US 4,936,927), Lütjering et al. (*Titanium*), and Yao et al. (US 6,066,359), as applied to claim 1, and further in view of Kobayashi et al. (EP 0 816 007 A2).

Regarding claim 8, Miyamoto et al., Grunke et al., Lütjering et al., and Yao et al. do not teach the claimed titanium alloy in contact with steel. Kobayashi et al. teach bonding a titanium aluminide rotor to a steel shaft to construct a turbine rotor (abstract). The rotor is titanium aluminide because it is less dense (light in weight) and harder than its nickel-base superalloy (col. 1, lines 14-34). It would have been obvious to one of ordinary skill in the art to have bonded the titanium-aluminum alloy of Miyamoto et al., Grunke et al., Lütjering et al., and Yao et al. to a steel shaft, as disclosed by Kobayashi

et al. because titanium-aluminum compounds possess properties superior than nickel-base superalloy in the manufacture of turbine rotors.

Calculation of Percent Al in Various Ti and Al Compounds

Al (M_{Al}) = 26.982 g/mol

Ti (M_{Ti}) = 47.867 g/mol

Mass % Al in $TiAl_2$ = 2 mol x 1 mol M_{Al} / (1 mol M_{Ti} + 2 mol x M_{Al}) = 0.52994

= 52.994 % by mass Al

Mass % Al in TiAl = 1 mol x M_{Al} / (1 mol M_{Ti} + 1 mol x M_{Al}) = 0.36049

= 36.049 % by mass Al

Mass % Al in Ti_3Al = 1 mol x M_{Al} / (3 mol M_{Ti} + 1 mol x M_{Al}) = 0.15818

= 15.818 % by mass Al

Response to Arguments

7. Applicant's arguments filed July 10, 2009 have been fully considered but they are not persuasive. Remarks directed to Lampman will not be addressed as new grounds of rejection have been made.

First, Applicant argues that there would be no motivation for one of ordinary skill in the art to have applied the coating of Grunke to Miyamoto because the alloy of Miyamoto is already sufficiently resistant to oxidation. The Examiner respectfully disagrees. One of the largest factors driving the need to innovate is to further improve upon and enhance what is already known. Therefore, one of ordinary skill in the art

would, at the very least, appreciate the positive effects of applying an aluminum coating on the alloy of Miyamoto, as the coating would further enhance the oxidation properties already present.

Second, Applicant argues that the concentration of Al in Grunke exceeds that amount that is claimed. In response, a review of the above calculations show that the aluminum is approximately 15.8% by mass in at least some portion of the coating.

Third, Applicant argues that it would not be obvious to apply an oxide layer on a material that is oxidation-resistant. In response, Applicant should not misconstrue oxidation-resistant as being equivalent to oxidation-proof. All materials oxidize under one condition or another. This is particularly true of titanium and aluminum alloys, as evidenced by Lütjering (page 48-49, para. 2.9.3; Fig. 2.32). Oxidation-resistant materials absorb oxygen at lower rates than others, making them appear to be oxidation-proof on larger time scales (Lütjering, Fig. 2.33). In reality, oxidation-resistant materials are still prone to oxidation, particularly if the temperature is particularly high (Lütjering, page 49). It would furthermore have been obvious to have grown additional oxide on the oxidation-resistant alloy in order to further improve resistance to corrosion (Yao et al.).

Fourth, Applicant argues that the oxidation process of Yao et al. would not produce the same oxide film as that produced by oxidizing a Ti-Al alloy. In response, the Ti-Al is inherently oxidized by ambient air (Lütjering, page 48-49, para. 2.9.3). Therefore, the process limitation has been satisfied.

Pertinent Prior Art

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent No. 6,599,636 to Alger teaches a titanium aluminide substrate on which titania and alumina are purposefully grown in order to form a protective coating.

Corrosion, edited by Shreir et al., teaches oxide formation in titanium and aluminum.

Conclusion

No claims are allowable. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Vanessa Velasquez whose telephone number is 571-270-3587. The examiner can normally be reached on Monday-Friday 9:00 AM-6:00 PM ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on 571-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Roy King/
Supervisory Patent Examiner, Art Unit 1793

/Vanessa Velasquez/
Examiner, Art Unit 1793